TMDLs FOR CHLORIDE, SULFATE, TDS, AND AMMONIA IN THE ELCC TRIBUTARY, ARKANSAS

(Reach 08040201-606)

December 16, 2002

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Prepared for

EPA Region VI
Watershed Management Section
Dallas, TX 75202

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be allocated to point sources and nonpoint sources discharging to the waterbody.

The El Dorado Chemical Company (ELCC) Tributary, which is located in Planning Segment 2D, flows into Flat Creek, which flows into Haynes Creek, which is a tributary of Smackover Creek in south central Arkansas in the Gulf Coastal Plain Ecoregion. The designated beneficial uses that have been established by the Arkansas Department of Environmental Quality (ADEQ) for all parts of the ELCC Tributary are seasonal Gulf Coastal fishery; secondary contact recreation; and domestic, industrial and agricultural water supply. Where the drainage area is 10 mi^2 or more, the designated uses also include perennial Gulf Coastal fishery and primary contact recreation (ADEQ 2000).

The numeric standards that apply to the ELCC Tributary for chlorides, sulfates, and total dissolved solids (TDS), are 19, 41, and 138 mg/L, respectively. ADEQ's historical water quality data for the ELCC Tributary show that the chloride, sulfates, and TDS standards are frequently exceeded. Because of this, the ELCC Tributary (reach 08040201-606) was included on the Arkansas 1998 303(d) list for not supporting aquatic life and water supply uses due to effluent and runoff from ELCC and nonpoint pollution from historical oil exploration activities in the watershed (ADEQ 2000).

Historical water quality data from ADEQ monitoring stations OUA137A through I during two time periods in the basin were analyzed and plotted to examine relationships, seasonal patterns, and long-term trends.

TMDLs for dissolved minerals (chlorides, sulfates, and TDS) were developed for the ELCC Tributary based on mean annual conditions. Total allowable loads were calculated based on the water quality standards and estimates of average annual streamflow. The dissolved mineral TMDLs for the ELCC Tributary included a background component, load allocations for man-induced nonpoint sources from the watershed, and an explicit margin of safety of 10%, plus wasteload allocations for three point sources (City of Norphlet, Wildwood Trailer Park, and ELCC non-stormwater outfalls) and load allocations for the ELCC stormwater discharges. The percent reductions required to meet the water quality standards for dissolved minerals in ELCC Tributary varied from 58% for chloride to 88% for TDS.

A TMDL for ammonia nitrogen was developed for the ELCC Tributary for low flow and high temperature conditions during summer and winter. The ammonia TMDL was developed to ensure that both of two conditions would be satisfied: 1) the oxygen demand from ammonia would not cause the DO standard to be violated, and 2) the instream ammonia concentrations would not exceed the EPA criteria for ammonia toxicity. Calculations and modeling showed that preventing ammonia toxicity required more stringent controls (i.e., higher percent reductions) than maintaining the DO standard. The ammonia TMDL was developed for both summer and winter and included wasteload allocations for the City of Norphlet, Wildwood Trailer Park, and ELCC non-stormwater discharges. An implicit margin of safety was incorporated through conservative assumptions. The ammonia concentrations for the ELCC non-stormwater discharges (outfalls 001 and 003) will need to be reduced by almost 98% during summer and 95% during winter.

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1.0 INTRODUCTION

The ELCC Tributary, which is located in Planning Segment 2D, flows into Flat Creek, which combines with Salt Creek to form Haynes Creek, a tributary of Smackover Creek within the Ouachita River Basin in hydrologic unit code (HUC) 08040201. An additional RF-1 river reach number was created for El Dorado Chemical Company (ELCC) Tributary as reach 606. The ELCC Tributary is located in south central Arkansas in the Gulf Coastal Plain ecoregion. The Arkansas Department of Environmental Quality (ADEQ) has established numeric water quality standards for chlorides, sulfates, and total dissolved solids (TDS) to protect the designated use of domestic, industrial, and agricultural water supply. The standards for chlorides, sulfates, and TDS are 19, 41, and 138 mg/L, respectively. Because the chlorides, sulfates, and TDS standards are exceeded frequently in the watershed, the ELCC Tributary (reach 606) was included on the Arkansas 1998 303(d) list for not supporting the aquatic life and water supply uses due to effluent and runoff from the ELCC and historical oil exploration activity (ADEQ 2000). Reach 606 was also listed for impairment of the aquatic life use due to ammonia toxicity. Therefore, the development of TMDLs for chloride, sulfates, TDS, and ammonia was required. These TMDLs were developed under Environmental Protection Agency (EPA) Contract #68-C-99-249, Work Assignment #2-124.

2.0 BACKGROUND INFORMATION

2.1 General Description

The ELCC Tributary is located in south central Arkansas in the Gulf Coastal Plain Ecoregion (Figure 2.1). The ELCC Tributary is in US Geological Survey (USGS) HUC 08040201 and ADEQ Planning Segment 2D. About 0.4 miles southeast of Norphlet, the unnamed tributary from El Dorado Chemical Company joins Flat Creek. The total drainage area of the basin at the confluence of ELCC Tributary and Flat Creek is approximately 22.8 mi^2 (USGS 1979), all of which is in Union County.

The ELCC Tributary watershed consists of a coastal plain of rolling terrain broken by stream valleys. Streams meander and are of moderate to low gradient (all less than 10 ft/mi). Substrate types are dominated by sand mixed with mud and silt, and rounded small sized gravel.

The soils in the basin are broadly classified as ultisols (SCS 1982) which are usually associated with forest vegetation and which have moderate to high permeability, argillic horizons, and low base saturations. The upland area soils are represented by the Briley, Darden, Harleston, Rosalie, Warnock, and Smithdale map units. Bibb and Guyton loams soils are found predominantly in the flood plains.

Of particular interest for this study is the Oil Wasteland-Fluvaquent complex, found on flood plains of local drainages and major streams. Mapped areas range from 20 to 1000 acres in size. Sixty percent of the mapped areas consist of oil and wasteland soils that have been impacted by oil and saltwater, typically lack plant cover, and are severely eroded. Even though these soils have been affected by oil waste and salt water runoff, they support salt water grasses and cattails.

2.2 Land Use

Land use in the ELCC Tributary basin is predominantly forest and pasture with some urban development. Historically, oil and gas development has occurred in the basin in the forest and wetland areas (Figure 2.2). Approximate percentages of each land use are shown in Table 2.1.

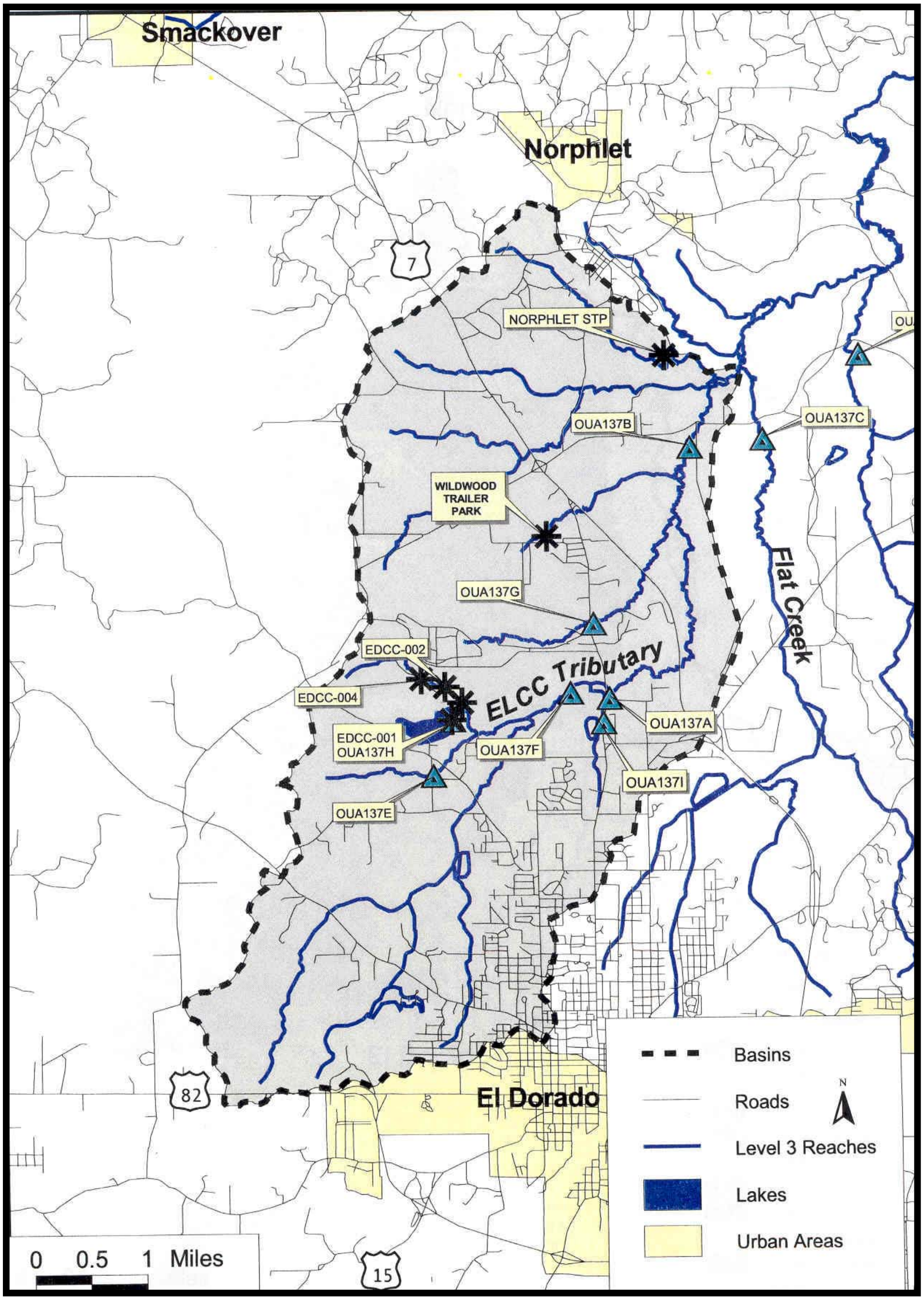

Figure 2.1. ELCC Tributary basin.

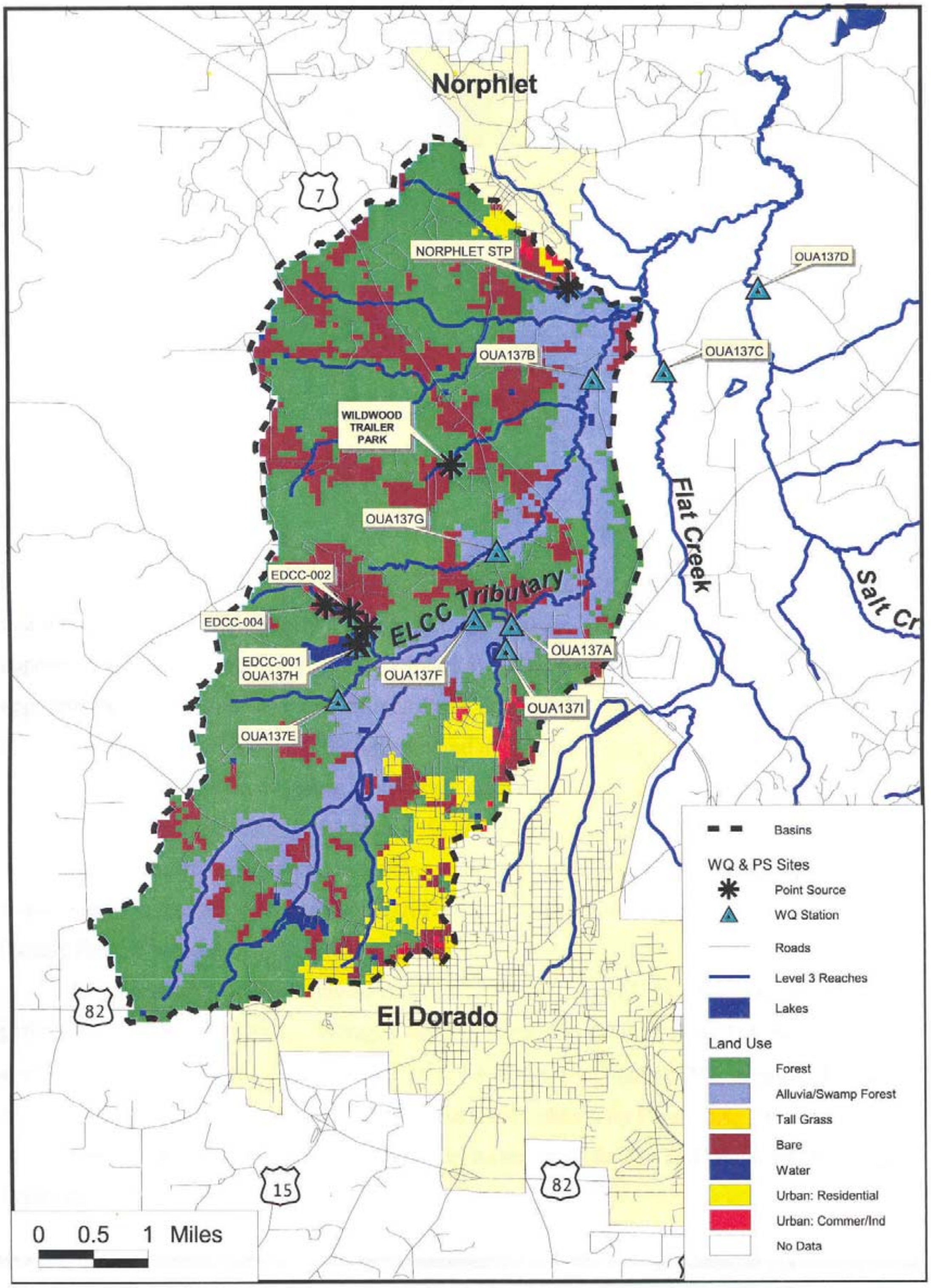

Figure 2.2. Land use.

Table 2.1. Land uses in the ELCC Tributary basin.

	ELCC Tributary (Reach 606)
Alluvial/Wetland Forest	17.9%
Forest	56.5%
Bare	18.4%
Water	1.2%
Urban Residential	5.5%
Urban Commercial	0.5%
Total	100.0%

Prior to development, the ELCC Tributary basin was predominantly bottomland hardwood forest.

2.3 Hydrology

A search for USGS flow monitoring gages within the ELCC Tributary basin indicated that there were no active or inactive flow gages. The nearest, most relevant USGS flow gage appears to be USGS Gage No. 07362100 (Smackover Creek near Smackover, AR). It is located approximately 8 miles northwest of the study area in the Gulf Coastal Plain ecoregion and has a drainage area of 385 mi^2 (USGS 2000) (compared to 22.8 mi^2 (USGS 1979) for the ELCC Tributary basin). Based on this gage, the average annual runoff for the ELCC Tributary basin is estimated to be approximately 15.0 inches (USGS 2000). The seasonal distribution of flow based on this gage is shown on Figure 2.3. Low flow months occur in late summer and high flow months occur in late winter to early spring. The 7Q10 critical low flows for ELCC Tributary are 0 cubic feet per second (cfs) (USGS 1992).

Precipitation data were obtained from the NWS station in El Dorado, which had a long period of record (1930 to 2000). Average annual precipitation for the ELCC Tributary basin is approximately 51.8 inches (Hydrosphere 2001) of which approximately 29% is runoff. Mean monthly precipitation totals for the El Dorado station are shown on Figure 2.4. The mean monthly precipitation values are highest from December through May and lowest for August and September.

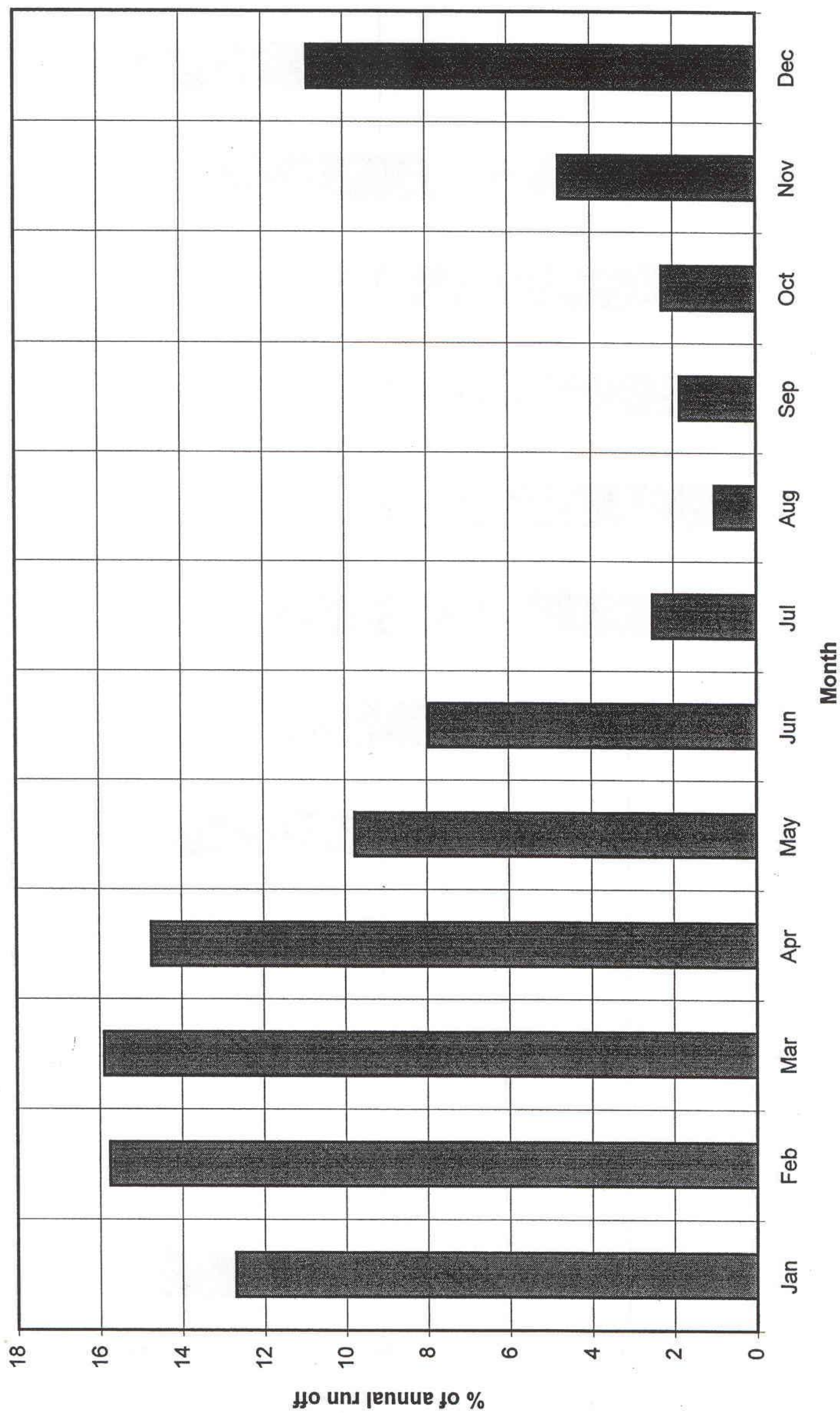

Figure 2.3. Seasonal distribution of flow for Smackover Creek near Smackover.

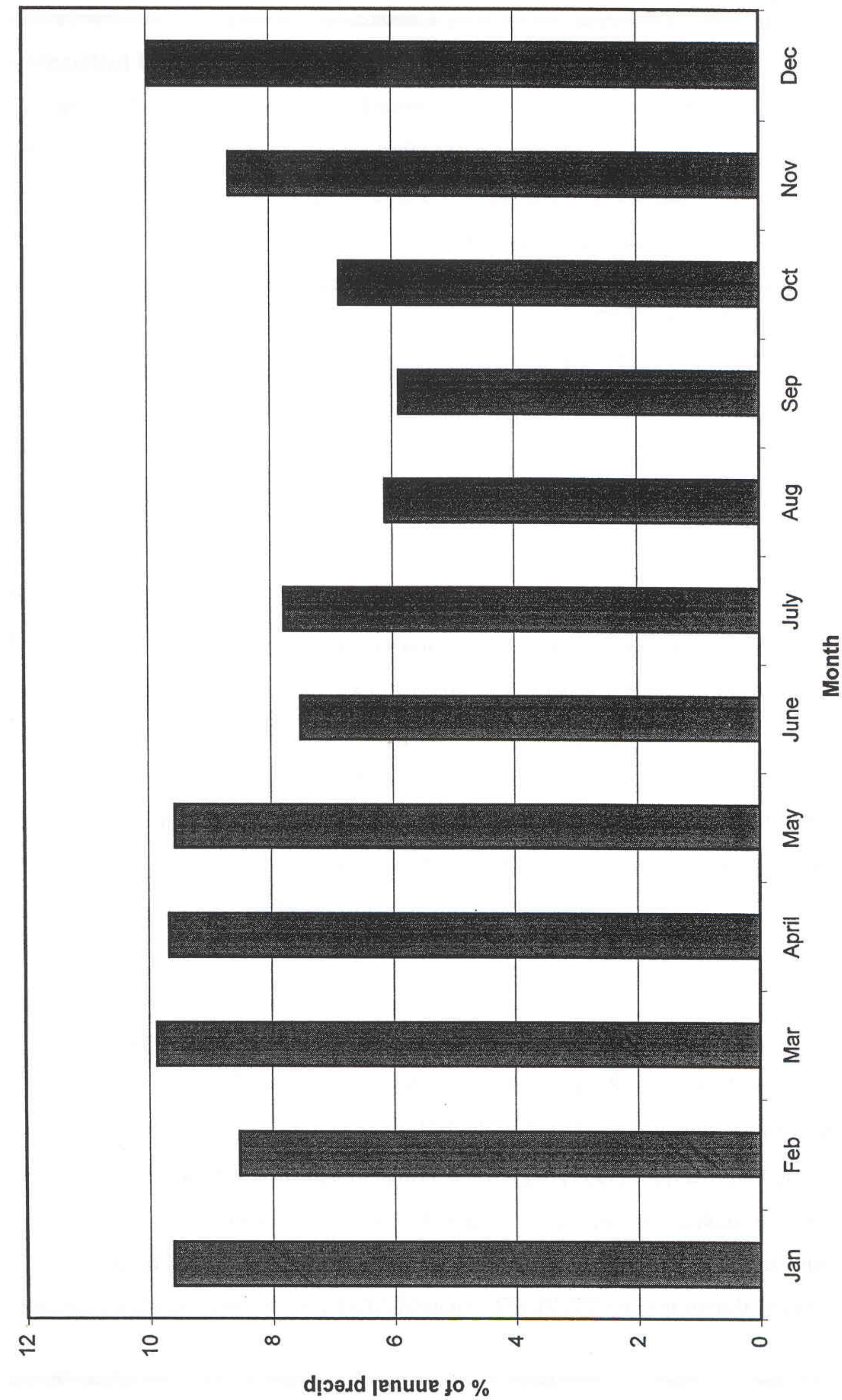

Figure 2.4. Monthly distribution of rainfall in El Dorado, Arkansas.

2.4 Designated Uses and Water Quality Standards

The State of Arkansas has developed water quality standards for waters of the state (ADEQ 2001). The standards are defined according to ecoregions and designated uses of the waterbodies. The ELCC Tributary basin lies entirely within the Gulf Coastal Plain ecoregion. Designated beneficial uses for the ELCC Tributary basin include seasonal Gulf Coastal fishery; secondary contact recreation; and domestic, industrial, and agricultural water supply. Where the drainage area is 10 mi^2 or more or there is a discharge with a design flow of 1 cfs or more, the designated uses also include perennial Gulf Coastal fishery and primary contact recreation. Because the design flow of ELCC Outfall 001 is 1.85 MGD (2.86 cfs), the ELCC tributary downstream of the ELCC outfalls is designated as a perennial fishery even though its drainage area is less than 10 mi^2. This designation has been previously documented by FTN (1991) and ADEQ (1998).

Dissolved mineral standards (i.e., chlorides, sulfates, and TDS) are addressed in Section 2.511 of the Arkansas Water Quality Standards (ADEQ 2001). The specific standards for the ELCC Tributary basin are:

CL – 19 mg/L
SO4 – 41 mg/L
TDS – 138 mg/L

A water quality study that was performed under contract to ELCC (FTN 1991) recommended that the water supply use be removed from the ELCC Tributary and that the water quality standards for dissolved minerals be increased for the ELCC Tributary. However, neither of these recommendations has been implemented to date.

There are no numeric standards for ammonia. High ammonia concentrations can, however, impair the designated fishery uses by creating an oxygen demand that lowers instream oxygen levels to below specified dissolved oxygen (DO) standards in Section 2.505 and by being toxic and violating the narrative criteria in Section 2.508. The DO standards for the ELCC Tributary basin during the critical season are 2 mg/L for streams designated as a seasonal fishery and 3 mg/L for streams designated as a perennial fishery. For the primary season, the DO standard is 5 mg/L.

2.5 Point Sources

Information on point source discharges in the ELCC Tributary basin (within HUC 08040201) was obtained by searching the Permit Compliance System (PCS) on the EPA website, reviewing ADEQ files, and reviewing information found in published technical reports. The search yielded three facilities with point source discharges (Table 2.2). Effluent data from the three facilities is summarized in Appendix A. Locations of the permitted facilities are shown on Figure 2.1. Based on ADEQ (1998), the El Dorado Chemical Company is a major source of dissolved minerals and ammonia to the ELCC Tributary. The ELCC current permit was renewed effective on May 31, 2002; previously the facility had been discharging under a Consent Administrative Order dated October 10, 1998.

2.6 Nonpoint Sources

Nonpoint sources of pollution in the watershed have been discussed in the latest 305(b) report (ADEQ 2000). ADEQ suggests that nonpoint source pollution is due to oil exploration activities from past and present. This is confirmed by the description of the soils in Section 2.1. There is no significant agricultural development with most of the land either being used for oil exploration or for timber for the forestry industry.

2.7 Previous Water Quality Studies

The following is a list of relevant water quality studies that were identified for the ELCC Tributary basin:

1. ADEQ. 1998. TMDL Investigation of Water Quality Impairment to Unnamed Tributary to Flat Creek, Union County, Arkansas. WQ-98-04-1. Published by Arkansas Department of Environmental Quality.
2. FTN. 1991. Surface Water Quality Study for El Dorado Chemical Company. Prepared by FTN for El Dorado Chemical Company.
3. GBM^c & Associates. 2001. Letter to ADEQ summarizing results of screening level bioassessment in unnamed tributary of Flat Creek.

Table 2.2. Summary of point source discharges in ELCC Tributary basin.

NPDES PERMIT NUMBER	FACILITY NAME	Design Flow (MGD)	Receiving Streams	Outfalls	PARAMETER	Monthly Average Limit
AR0044733	Wildwood Trailer Park	0.031	Tributary to Flat Creek	001	TSS	30 mg/L
					Total Ammonia Nitrogen (summer)	5 mg/L
					Total Ammonia Nitrogen (winter)	13 mg/L
					Fecal Coliform	1000 N/ml
					CBOD, 5 day	20 mg/L
AR0035653	City of Norphlet	0.18	Tributary to Flat Creek	001	TSS	30 mg/L
					Total Ammonia Nitrogen	6 mg/L
					Fecal Coliform	1000 N/ml
					CBOD, 5 day	20 mg/L
AR0000752	El Dorado Chemical Co.			001	TSS	30 mg/L
					Ammonia Nitrogen	
					Nitrate Nitrogen	
					DO (June-October)	4 mg/L
					DO (November-May)	6 mg/L
					Sulfates	
				002	Oil and Grease	10 mg/L
					Ammonia Nitrogen	
					TSS	
				003	CBOD	25 mg/L
					TSS	30 mg/L
					Ammonia Nitrogen (May-October)	10 mg/L
					Ammonia Nitrogen (November-April)	15 mg/
					Fecal Coliform	1000 N/ml
				004	Oil and Grease	15 mg/L
					Ammonia Nitrogen	
					TSS	

3.0 CHARACTERIZATION OF EXISTING WATER QUALITY

3.1 Inventory of Data

Information on water quality monitoring stations in ELCC Tributary basin (within HUC 08040201) was obtained by searching the EPA STORET database and from reviewing technical reports of studies in the area. The search was conducted for data collected by all agencies at all water quality stations on ELCC Tributary streams in the previously mentioned HUC code. The search yielded only the stations that were included in the ADEQ report (ADEQ 1998). One USGS water quality monitoring station was found near the watershed. Data for that station (07362203, Haynes Creek near Norphlet) were retrieved from the USGS website but included only three sampling events for chloride, sulfate, and TDS.

3.2 Assessment Reports

The most relevant data for this study were collected by ADEQ and documented in a report titled "TMDL Investigation of Water Quality Impairment to Unnamed Tributary to Flat Creek, Union County, Arkansas" (ADEQ 1998). Water quality data were collected by ADEQ from 9 sampling locations on several occasions throughout the watershed from January 1995 to July 1996 and from March 1997 to December 1997. Parameters measured included flow, sulfates, chlorides, TDS, ammonia, and a suite of other parameters including biological data (Appendix B). These data were used to support this TMDL. The ADEQ report summarizes these data and presents the following conclusions:

a. "Water quality data demonstrates problem areas of minerals, heavy metals, ammonia, and nitrates."
b. "The ELCC tributary exhibits substantially elevated sulfate and total dissolved solids; … consistent, in-stream toxic affects to test organisms existed; and impairment of the indigenous biota of the stream was identified."
c. "Flat Creek receives elevated levels of sulfates and TDS from the ELCC tributary and very high levels of chlorides from its upstream watershed."
d. "Stormwater runoff from the north side of the ELCC plant results in toxic levels of copper, zinc, and ammonia in the tributary stream approximately 1 mile below the facility."

e. "Toxicity was strongly correlated with in-stream pH and was much more severe on the minnow than the *Ceriodaphnia*, thus indicating ammonia as the primary toxic compound."

ADEQ (1998) also indicated that in October 1994, the ELCC submitted a request to the ADEQ to modify the water quality standard for dissolved minerals for several streams in the Flat Creek/Salt Creek basin and to increase its ammonia discharge limits. The request was withdrawn due to concerns about aquatic life impairment in the ELCC Tributary (ADEQ 1998). Field data and modeling studies supporting the request are found in FTN (1991).

3.3 Data Analysis

3.3.1 Dissolved Minerals

Table 3.1 summarizes the dissolved minerals data collected by ADEQ (1998) for representative stations for the reach of interest in this study (08040201-606). Data for all the ADEQ stations are summarized in Appendix B. In the ELCC Tributary to Flat Creek, dissolved minerals concentration exceeded water quality standards (WQS) the majority of the time, with some dilution occurring moving downstream from Stations OUA137F and OUA137A to OUA137B (Figures 3.1 through 3.3, located in Appendix C). Station OUA137E was located upstream of the ELCC facility and also exhibited high TDS and chloride concentrations (Appendix B) that routinely exceeded WQS. Sulfate concentrations at Station OUA137E were less than the WQS. Although the data are limited, comparisons of data from OUA137E (located upstream of ELCC) with stations OUA137G and OUA137A (located downstream of ELCC) clearly indicate ELCC to be a source of high dissolved minerals both from point and nonpoint sources.

3.3.2 Ammonia

The ELCC Tributary was also on the 303(d) list for ammonia toxicity and impairment of its aquatic life uses. Ammonia concentrations for the ELCC Tributary are summarized in Table 3.2. Compared to concentrations in Flat and Salt Creeks, ammonia concentrations in the ELCC Tributary are at least an order of magnitude higher. As with dissolved minerals, comparison of concentrations from the upstream station (OUA137E) with downstream stations indicate the ELCC facility as both a point and a nonpoint source contributor of ammonia.

Table 3.1. Summary of instream dissolved mineral data.

	ELCC Unnamed Tributary (08040201-606)		
	OUA137A	**OUA137B**	**OUA137F**
Chloride (mg/L)			
Period of Record for statistics	1/95 to 12/97	1/95 to 12/97	1/95 to 12/97
Number of samples	12	12	4
Minimum	20.1	15.0	23.8
Maximum	71.9	63.6	70.1
Median	32.8	26.7	33.3
Number above standards	12	9	4
Percent above standards	100%	75%	100%
Sulfate (mg/L)			
Period of Record for statistics	1/95 to 12/97	1/95 to 12/97	1/95 to 12/97
Number of samples	12	12	4
Minimum	47.6	33.4	49.8
Maximum	700	2970	412
Median	124	63.6	77.1
Number above standards	12	10	4
Percent above standards	100%	83%	100%
TDS (mg/L)			
Period of Record for statistics	1/95 to 12/97	1/95 to 12/97	1/95 to 12/97
Number of samples	12	12	4
Minimum	206	159	307
Maximum	1,589	1,447	1,373
Median	372	444	355
Number above standards	12	12	4
Percent above standards	100%	100%	100%

Table 3.2. Summary of instream ammonia data.

	ELCC unnamed Tributary (08040201-606)			Flat Creek (08040201-706)	Salt Creek (08040201-806)
	OUA137A	OUA137B	OUA137F	OUA137C	OUA137D
Period of Record for statistics	1/95 to 12/97	1/95 to 12/97	1/95 to 12/97	1/95 to 12/97	1/95 to 12/97
Number of samples	12	12	8	11	12
Minimum	5.55	2.25	6.8	0.025	0.025
Maximum	54.1	48.3	72	4.74	0.709
Median	20.2	9.7	33.2	0.20	0.067

4.0 TMDL DEVELOPMENT

4.1 Dissolved Minerals

In this section, the TMDLs for dissolved minerals (chlorides, sulfates, and TDS) for the ELCC Tributary upstream of its confluence with Flat Creek are developed. It is assumed that successful implementation of the TMDL for upper Flat Creek and the ELCC Tributary will result in the lower part of Flat Creek meeting water quality standards. Printouts of the spreadsheets with the TMDL computations are included in Appendix D.

4.1.1 Seasonality and the Determination of Critical Conditions

The historical data and analyses discussed in Section 3.0 were used to evaluate whether there were certain flow conditions, spatial locations, or certain periods of the year that could be used to characterize critical conditions. Although dissolved mineral concentrations appeared to be slightly higher during the summer low flow months, no significant relationships were found for dissolved minerals with flow or season. Sources of dissolved minerals in the ELCC Tributary include both point sources and nonpoint sources, indicating all seasons are important. The exceedances of water quality standards for dissolved minerals occurred fairly uniformly throughout the year in the ELCC Tributary. Also, Arkansas's water quality standards for dissolved minerals are not seasonal. Due to year-round standards and limited data, including no flow data, no critical conditions were identified for the dissolved minerals TMDLs for the ELCC Tributary and mean annual conditions were used.

Because there are point sources contributing dissolved minerals during low flow conditions, permit limits for those point sources will need to be evaluated under critical low flow conditions. Since development of point source permit limits for different flow conditions was considered to be part of the implementation of the TMDL, it is not included here.

4.1.2 Linking Water Quality and Pollutant Sources

The high dissolved mineral concentrations in the ELCC Tributary have been attributed to point source discharges and stormwater runoff from ELCC (ADEQ 1998). Historical oil field development that left oil waste and salt water must also be considered as a source. Chlorides, TDS, and sulfates concentrations exceeded water quality standards in the ELCC Tributary in the majority of the samples collected. Exceedances of the chlorides and TDS standards at station OUA137E (upstream of ELCC) indicate other nonpoint sources of pollution in addition to ELCC. Since concentrations appear to decrease in a downstream direction, sources of high dissolved minerals appear to be located in the upper reaches of the watershed.

4.1.3 Current Load

Current loads of dissolved minerals for the ELCC Tributary were calculated using the average instream dissolved mineral concentrations and the average annual flow for the stream. The following equation was used to compute the loads:

Load in lbs/day = C x Q x 8.34

where C = concentration in mg/L and Q = flow in MGD.

Mean annual conditions were used since the limited available data did not indicate any significant seasonality or critical conditions. For the concentrations, averages of the data collected at station OUA137B were used. The mean annual flow was estimated by using the watershed area of the ELCC Tributary at its confluence with Flat Creek and multiplying it by the mean annul runoff for the USGS gage at Smackover (i.e., 15 inches per year).

Because the City of Norphlet's discharge enters the ELCC Tributary downstream of station OUA137B, its loads were added to the loads calculated for station OUA137B. The City of Norphlet loads were calculated using average flows from DMRs and typical concentrations for treated municipal wastewater. These typical concentrations were based on information in EPA (1997) and Metcalf and Eddy (1979) and their values were 70 mg/L chlorides, 45 mg/L sulfates, and 500 mg/L TDS. These calculations are shown in Table D.1 (in Appendix D).

4.1.4 TMDL

The allowable loads (i.e., TMDLs) for dissolved minerals were calculated by multiplying the existing water quality standards (Section 2.4) by the same mean annual flow that was used to calculated current loads. The calculations are shown in Table D.2 and the results are included in Table 4.1.

Table 4.1. Dissolved minerals TMDL for ELCC Tributary (08040201-606).

	ELCC Tributary		
	Chlorides (lbs/day)	**Sulfates (lbs/day)**	**TDS (lbs/day)**
WLA for Wildwood Trailer Park	18	12	129
WLA for City of Norphlet	105	68	751
WLA for ELCC non-stormwater	265	503	1,338
LA for ELCC stormwater	73	33	635
LA for man-induced watershed NPS	1,243	2,775	5,816
LA for background sources	671	1,746	8,996
MOS	176	368	865
TMDL	2,551	5,505	18,530
Percent reduction for ELCC and man-induced watershed NPS	58%	86%	88%

4.1.5 Wasteload Allocations and Load Allocations

The sources of dissolved minerals for the ELCC Tributary were grouped as follows:

- Background loads
- City of Norphlet and Wildwood Trailer Park
- ELCC non-stormwater outfalls (001 and 003) - considered as point source
- ELCC stormwater outfalls (002, 004, 005, 006, and 007) - considered as NPS
- Man-induced nonpoint source loads from the watershed

The background loads were calculated using the ADEQ reference stream data for the Gulf Coastal Plain ecoregion (from the ADEQ Continuing Planning Process (CPP) document) and the mean annual flow rate for the ELCC Tributary. Calculations for background loads are included in Table D.3.

The wasteload allocations (WLAs) for the City of Norphlet and Wildwood Trailer Park were set based on current design flows and the typical dissolved mineral concentrations for treated municipal wastewater presented above (70 mg/L chlorides, 45 mg/L sulfates, and 500 mg/L TDS). The current design flows obtained from EPA's Permit Compliance System (PCS) were 0.18 MGD for the City of Norphlet and 0.031 MGD for Wildwood Trailer Park. No reductions were proposed for these point sources because their discharges are small. Calculations for these two WLAs are shown in Table D.3.

The three sources that were targeted for reductions were ELCC non-stormwater discharges, ELCC stormwater discharges, and man-induced nonpoint source contributions from the watershed. The WLAs and LAs for these three sources were determined based on a uniform percent reduction for all three sources. The percent reduction for these sources was calculated as outlined in the following steps (calculations are shown in Table D.4):

1. The total current loads for the ELCC Tributary were calculated as described in Section 4.2.3 and the TMDLs were calculated as described in Section 4.2.4.
2. The combined current loads for the three sources targeted for reduction were computed using the following equation:

$$\begin{matrix}\text{Combined current load} \\ \text{for 3 targeted sources}\end{matrix} = \begin{matrix}\text{ELCC trib total} \\ \text{current load}\end{matrix} - \begin{matrix}\text{Background} \\ \text{load}\end{matrix} - \begin{matrix}\text{Norphlet} \\ \text{WLA}\end{matrix} - \begin{matrix}\text{Wildwood} \\ \text{WLA}\end{matrix}$$

3. For the three sources targeted for reduction, the maximum allowable combined loads to maintain standards were computed from the following equation (which incorporates an explicit margin of safety that is 10% of the three targeted sources):

$$\begin{matrix}\text{Combined allowable load} \\ \text{for 3 targeted sources}\end{matrix} = \left[\text{TMDL} - \begin{matrix}\text{Background} \\ \text{load}\end{matrix} - \begin{matrix}\text{Norphlet} \\ \text{WLA}\end{matrix} - \begin{matrix}\text{Wildwood} \\ \text{WLA}\end{matrix}\right] \times 90\%$$

4. The percent reduction for each constituent was then calculated from the results of the previous two steps:

$$\text{Percent reduction} = 100\% \times \left[\begin{matrix}\text{Combined}\\ \text{current load}\end{matrix} - \begin{matrix}\text{Combined}\\ \text{allowable load}\end{matrix} \right] \div \begin{matrix}\text{Combined}\\ \text{current load}\end{matrix}$$

For each constituent, the combined allowable load for the three targeted sources was divided among the three sources proportional to their current loads. The current loads for the ELCC non-stormwater discharges were calculated using the combined design flows for Outfalls 001 and 003 (which were back calculated from mass and concentration permit limits) and average concentrations from DMRs and from field studies during 1991 (calculations are shown in Table D.5).

For the ELCC stormwater discharges, the current loads were calculated based on an estimated annual volume of runoff and average concentrations from observed data. The annual volume of runoff was estimated by multiplying the size of the manufacturing area within the ELCC facility (approximately 300 acres according to FTN 1991) times the average annual runoff for the USGS gage on Smackover Creek (15 inches). The average concentrations of dissolved minerals for the ELCC stormwater outfalls were computed by averaging all available data for each outfall (from DMRs and from field studies during 1991) and then taking the averages for all of the outfalls (calculations are shown in Table D.6).

The current load for man-induced nonpoint source contributions from the watershed was then estimated as the remainder of the combined current load for the three targeted sources (calculations are shown in Table D.7):

$$\begin{matrix}\text{Current load for man-}\\ \text{induced w'shed NPS}\end{matrix} = \begin{matrix}\text{Combined current load}\\ \text{for 3 targeted sources}\end{matrix} - \begin{matrix}\text{Current ELCC}\\ \text{non-storm load}\end{matrix} - \begin{matrix}\text{Current ELCC}\\ \text{stormwater load}\end{matrix}$$

4.1.6 Margin of Safety

Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7 require the inclusion of a margin of safety (MOS) in the development of a TMDL. For the dissolved minerals TMDLs for the ELCC Tributary, the explicit MOS was set to 10% of the loads targeted for reduction.

4.2 Ammonia

The TMDL for ammonia for the ELCC Tributary is based on maintaining the applicable DO standard as well as not exceeding EPA's criteria for ammonia toxicity. The maximum allowable ammonia concentrations to maintain the DO standard were based on a calibrated QUAL2E model that was developed in a previous study (FTN 1991). The documentation for the QUAL2E modeling is presented in Appendix E. The calculations for ammonia toxicity were based on published criteria (EPA 1999) are shown in Appendix F.

4.2.1 Seasonality and Determination of Critical Conditions

Critical conditions for the ammonia TMDL were based on the sources of ammonia in the ELCC Tributary and environmental conditions that are most critical for maintaining the DO standard and not exceeding ammonia toxicity criteria. Currently, the majority of the ammonia load to the ELCC Tributary is point source loading; critical conditions for point sources are usually characterized by low upstream flow, which causes reduced dilution. For maintaining the DO standard, critical periods are typically characterized by high temperature and low flow. High temperatures decrease DO saturation values and increase nitrification rates. Low flows provide less dilution for point source discharges and can have lower reaeration rates due to decreased velocity in the stream. For ammonia toxicity, critical conditions are usually high temperatures because the allowable instream concentrations decrease as temperature increases. Based on this information, critical conditions for the ammonia TMDL were defined as 7Q10 flows and maximum allowable water temperatures.

Because the DO standards for the ELCC Tributary are seasonal and the EPA criteria for ammonia toxicity are dependent on temperature, the ammonia TMDL was computed for both summer and winter seasons. For the summer season, the applicable DO standard is 3 mg/L (Section 2.4), the maximum allowable temperature is 30°C (ADEQ 2001), and the annual 7Q10 is zero (Section 2.3). For the winter season, the DO standard is 5 mg/L (Section 2.4), the critical temperature was set to 22°C, and the upstream flow at the ELCC outfalls was set to 1.0 cfs. The critical temperature for winter was based on requirements for meeting the DO standard during the primary season (ADEQ 2001). The 1.0 cfs flow upstream of the ELCC outfalls was developed for seasonal conditions in a previous study (FTN 1991).

4.2.2 Linking Water Quality and Pollution Sources

The high ammonia concentrations in the ELCC Tributary have been attributed to both point source (i.e., continuous) and nonpoint source (i.e., stormwater) discharges from ELCC (ADEQ 1998). Comparison of samples at station OUA137E (upstream) with samples from downstream stations (OUA137F and OUA137A) clearly indicates ELCC to be a source of ammonia (Section 3.3.2). Data collected downstream of ELCC's stormwater outfalls (station OUA137G) also showed some elevated ammonia concentrations. Other minor sources of ammonia within the basin include treated wastewater from the City of Norphlet and Wildwood Trailer Park.

4.2.3 Maximum Allowable Concentrations

Development of the ammonia TMDL required two parallel tasks: 1) modeling to determine the maximum ammonia concentrations to maintain the DO standard, and 2) spreadsheet calculations to determine the maximum ammonia concentrations that would not exceed EPA's criteria for ammonia toxicity. The results of these two parallel tasks were compared and the results from the task with lower allowable ammonia concentrations were then used for the TMDL calculations.

The maximum allowable ammonia concentrations for maintaining the DO standard were determined from a calibrated QUAL2E model that was documented in a previous study (FTN 1991). Appendix E of this report contains excerpts from the 1991 FTN report that describe the model set up and calibration, the projection runs, and the model results. The 1991 FTN report showed that the DO standard would be maintained with ELCC outfall 001 discharging at ammonia nitrogen concentrations of 28 mg/L in summer and 38 mg/L in winter. Because the upstream flows were 0 cfs for summer and 1 cfs for winter, the instream ammonia nitrogen concentrations predicted by the model just downstream of outfall 001 were similar to the discharge concentrations.

The maximum allowable ammonia concentrations based on ammonia toxicity were calculated using EPA's most recent published criteria (EPA 1999). These criteria are dependent on temperature and pH. The pH values used in these calculations were the average pH for each season at station OUA137A (downstream of ELCC outfall 001). The temperatures used in these calculations were the same as the critical temperature discussed above (30°C for summer and 22°C for winter). The resulting maximum instream concentrations of ammonia nitrogen were 2.43 mg/L for summer and 4.17 mg/L for winter. These calculations are shown in Table F.1 (in Appendix F).

Based on the results of these two parallel tasks, the allowable ammonia concentrations are limited by ammonia toxicity rather than by maintaining the DO standard. Therefore, the ammonia TMDL was based on the ammonia toxicity calculations rather than the DO modeling. Because ammonia is not a conservative substance, the ammonia TMDL was developed by calculating individual components of the TMDL and adding them together rather than first calculating the total load for the basin and then dividing it into individual components.

4.2.4 Wasteload Allocations

Wasteload allocations for ammonia were developed for ELCC outfalls 001 and 003, the City of Norphlet, and Wildwood Trailer Park. Because ammonia is a non-conservative substance and these three facilities are located relatively far apart, each facility was considered independently. For each facility and each season, a mass balance was used to calculate the allowable discharge concentration based on the allowable instream concentration of ammonia immediately downstream of the outfall. The upstream ammonia concentration in the mass balance calculations was set to the average measured value at station OUA137E. All three facilities were assumed to have the same upstream flow because the upstream drainage areas appear to be similar in size. The mass balance calculations are shown in Table F.2.

The wasteload allocations will require reductions in ammonia concentrations for the ELCC outfalls but not for the City of Norphlet or Wildwood Trailer Park. Ammonia concentrations at ELCC outfall 001 will have to be reduced almost 98% during summer and 95% during winter in order for instream concentrations to stay below the EPA criteria for ammonia toxicity (based on the medians of DMR concentrations for September 1999 through September 2001). The wasteload allocations and other components of the ammonia TMDL are shown in Table 4.2.

Table 4.2. Ammonia TMDL for ELCC Tributary (08040201-606).

	ELCC Tributary	
	Summer (lbs/day)	**Winter (lbs/day)**
WLA for City of Norphlet	3.65	27.01
WLA for Wildwood Trailer Park	0.63	21.82
WLA for ELCC Outfall 001	37.90	85.78
LA for watershed nonpoint sources	0.00	5.16
MOS	incorporated through conservative assumptions	
TMDL	42.18	139.77

4.2.5 Load Allocations

Load allocations for nonpoint source contributions of ammonia from the watershed were calculated by multiplying the upstream flows times the upstream concentrations in the mass balance. Because the annual 7Q10 is zero, the summer load allocation was zero. For winter, the total load allocation was 3 cfs (1 cfs upstream of each facility) times the upstream concentration (0.32 mg/L). Other winter inflows to the ELCC Tributary (i.e., farther downstream) were neglected in these TMDL calculations because they have no effect on the loadings at the critical locations in the basin (the points immediately downstream of each outfall).

The load allocations for ammonia were not divided between man-induced and natural background because the nonpoint source contributions from the watershed are small compared to contributions from point sources.

4.2.6 Margin of Safety

Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7 both require the inclusion of a margin of safety (MOS) in the development of a TMDL. An implicit MOS was incorporated in the ammonia TMDLs through the use of conservative assumptions. These conservative assumptions include:

- Using design flows rather than typical effluent flows to calculate WLAs
- Using critical upstream flows that are exceeded most of the time
- Using critical temperatures that are rarely equaled or exceeded
- Assuming that critical low flows and critical temperatures occur simultaneously

5.0 MONITORING AND IMPLEMENTATION

In accordance with Section 106 of the Federal Clean Water Act and under its own authority, ADEQ has established a comprehensive program for monitoring the quality of the State's surface waters. ADEQ collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for long term trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters.

Point source reductions for these TMDLs will be implemented through the NPDES program, which is administered in Arkansas by ADEQ.

6.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, federal regulations require EPA to publicly notice and seek comment concerning the TMDL. Pursuant to a May 2000 consent decree, these TMDLs were prepared under contract to EPA. After developing the TMDLs, EPA prepared a notice seeking comments, information, and data from the general public and affected public. Comments and additional information were submitted during the public comment period, and these TMDLs were revised accordingly. Responses to these comments and additional information are included in Appendix G. EPA has transmitted the revised TMDLs to the ADEQ for implementation and incorporation into ADEQ's current water quality management plan.

7.0 REFERENCES

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APPENDIX A

Summary of Point Source Effluent Data

Table A1. Summary of DMR data for El Dorado Chemical Company.

El Dorado Chemical Company												
		Ammonia (mg/L)		TSS(mg/L)		FLOW (Mgd)		CBOD5(mg/L)		DO (mg/L)	Sulfates (mg/L)	
		AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	MIN	AVG	MAX
OUTFALL	001											
BEGIN DATE		9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	36433			9/30/99	9/30/99	9/30/99
END DATE		9/30/01	9/30/01	9/30/01	9/30/01	9/30/01	37164			9/30/01	9/30/01	9/30/01
NUMBER OF DATA POINTS		18	18	18	18	18	18			18	18	18
MIN		57.4	69.4	2.7	3.1	0.2402	0.5370			7.0	75.0	102.0
MAX		280.0	322.0	37.0	45.6	1.4116	4.7923			10.2	485.1	704.0
MEDIAN		104.7	116.5	12.5	17.0	0.4680	1.3224			8.5	231.2	261.0
AVERAGE		121.3	149.4	13.2	19.0	0.5883	1.4642			8.5	238.7	278.2
OUTFALL	003											
BEGIN DATE		10/31/99	10/31/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99			
END DATE		10/31/01	10/31/01	9/30/01	9/30/01	9/30/01	9/30/01	9/30/01	9/30/01			
NUMBER OF DATA POINTS		9	9	9	9	25	25	9	9			
MIN		0.5	0.5	0.5	0.5	0.0094	0.0096	0.00	0.00			
MAX		2.5	2.5	3.2	3.2	0.0240	0.0340	3.70	3.70			
MEDIAN		1.6	1.6	1.0	1.0	0.0112	0.0117	1.00	1.00			
AVERAGE		1.6	1.6	1.2	1.2	0.0120	0.0133	1.42	1.42			
OUTFALL	004											
BEGIN DATE			9/30/99		9/30/99	9/30/99	9/30/99					
END DATE			6/30/01		6/30/01	6/30/01	6/30/01					
NUMBER OF DATA POINTS			17		17	17	17					
MIN			8.4		8.4	0.0074	0.0255					
MAX			1001.0		342.0	0.0910	1.4930					
MEDIAN			487.0		46.9	0.0281	0.3990					
AVERAGE			451.4		74.6	0.0362	0.4723					

Table A2. Summary of DMR data for the City of Norphlet.

Norphlet											
	Ammonia (mg/L)		TSS(mg/L)		FLOW (Mgd)		CBOD5(mg/L)		DO (mg/L)	Sulfates (mg/L)	
	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	MIN	AVG	MAX
BEGIN DATE	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99		
END DATE	7/31/01	7/31/01	7/31/01	7/31/01	7/31/01	7/31/01	7/31/01	7/31/01	8/31/01		
NUMBER OF DATA POINTS	12	12	18	18	19	19	18	18	8		
MIN	6.90	6.90	1.6	2.0	0.0177	0.0406	2.0	2.0	1.90		
MAX	0.10	0.10	71.7	78.0	0.5414	0.6823	8.0	8.0	4.47		
MEDIAN	9.70	10.80	6.3	10.0	0.0893	0.1811	4.3	5.0	3.00		
AVERAGE	3.28	4.20	13.3	16.4	0.1246	0.2577	4.5	5.1	3.08		

Table A3. Summary of DMR data for Wildwood Trailer Park.

Wildwood Trailer Park											
	Ammonia (mg/L)		TSS(mg/L)		FLOW (Mgd)		CBOD5(mg/L)		DO (mg/L)	Sulfates (mg/L)	
	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	MIN	AVG	MAX
BEGIN DATE	10/31/99	10/31/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	10/31/99		
END DATE	7/31/01	7/31/01	6/30/01	6/30/01	8/31/01	8/31/01	6/30/01	6/30/01	7/31/01		
NUMBER OF DATA POINTS	8	8	8	8	23	23	8	8	4		
MIN	0.10	0.10	2.0	2.0	0.0028	0.0115	2.0	2.0	2.00		
MAX	7.80	7.80	22.2	53.0	0.0495	0.0504	6.0	6.0	4.69		
MEDIAN	1.30	1.30	9.0	9.0	0.0261	0.0288	3.5	3.5	2.95		
AVERAGE	2.80	2.80	10.4	14.3	0.0269	0.0319	3.7	3.7	3.15		

APPENDIX B

Summary of ADEQ Water Quality Data

Table B1. Summary of In-Stream Chloride Data.

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D	OUA0137E	OUA0137H	OUA0137F	OUA0137G	OUA0137I
Period of Record for statisitics	1997 March to December								
Number of samples	1	1	1	1	5	4	4	5	1
MIN	25.498	27.92	254.4	771	19.0	41.8	23.8	18.3	16.475
MAX	NA	NA	NA	NA	46.7	77.9	70.1	31.4	NA
MEDIAN	NA	NA	NA	NA	35.1	63.4	33.3	22.9	NA
# above standards	1	1	1	1	4	3	4	3	0
% above standards	100	100	100	100	80	75	100	60	0

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D
Period of Record for statisitics	1995 -1996 January to July			
Number of samples	11	11	10	11
MIN	20.1	15.0	17	170
MAX	71.9	63.6	1160	2970
MEDIAN	34.1	25.5	293	1020
# above standards	11	8	9	11
% above standards	100.0	72.7	90.0	100.0

Table B2. Summary of In-Stream Sulfate Data.

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D	OUA0137E	OUA0137H	OUA0137F	OUA0137G	OUA0137I
Period of Record for statisitics	1997 March to December								
Number of samples	1	1	1	1	5	4	4	5	1
MIN	73.6	50.8	70.9	1.7	3.98	184	49.8	12.5	12
MAX	NA	NA	NA	NA	16.2	553	412	74.2	NA
MEDIAN	NA	NA	NA	NA	12.7	233	77.1	38.6	NA
# above standards	1	1	1	0	0	4	4	1	0
% above standards	100	100	100	0	0	100	100	20	0

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D
Period of Record for statisitics	1995 -1996 January to July			
Number of samples	11	11	10	11
MIN	47.6	33.4	9.3	2.3
MAX	700	652	125	11.6
MEDIAN	124	41.7	41.7	7.4
# above standards	11	9	5	0
% above standards	100.0	81.8	50.0	0.0

Table B3. Summary of In-Stream TDS Data.

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D	OUA0137E	OUA0137H	OUA0137F	OUA0137G	OUA0137I
Period of Record for statisitics	1997 March to December								
Number of samples	1	1	1	1	5	4	4	5	1
MIN	303	229	675	1562	104	734	307	163	131
MAX	NA	NA	NA	NA	174	1769	1373	284	NA
MEDIAN	NA	NA	NA	NA	144	1238	355	216	NA
# above standards	1	1	1	1	4	4	4	5	0
% above standards	100	100	100	100	80	100	100	100	0

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D
Period of Record for statisitics	1995 -1996 January to July			
Number of samples	11	11	10	11
MIN	206	159	496	780
MAX	1589	1447	2000	5231
MEDIAN	440	393	659	1704
# above standards	11	11	10	11
% above standards	100.0	100.0	100.0	100.0

Table B4. Summary of In-Stream Ammonia Nitrogen Data.

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D	OUA0137E	OUA0137H	OUA0137F	OUA0137G	OUA0137I
Period of Record for statisitics	1997 (PC&E) March to December								
Number of samples	1	1	1	1	5	4	4	5	1
MIN	11	5.57	0.187	0.165	0.20	12.66	6.80	0.03	<0.05
MAX	NA	NA	NA	NA	0.43	246	56.9	114	NA
MEDIAN	NA	NA	NA	NA	0.30	32.45	22.9	4.64	NA

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D	OUA0137E	OUA0137H	OUA0137F	OUA0137G
Period of Record for statisitics	1997(EPA) March to December							
Number of samples	NA	NA	NA	NA	5	4	4	5
MIN	NA	NA	NA	NA	1	40.8	20.4	0.4
MAX	NA	NA	NA	NA	9.6	360	72	34
MEDIAN	NA	NA	NA	NA	1.2	55.2	39.2	13.2

Station Name	OUA0137A	OUA0137B	OUA0137C	OUA0137D
Period of Record for statisitics	1995 -1996(PC&E) January to July			
Number of samples	11	11	10	11
MIN	5.55	2.25	0.06	0.06
MAX	54.1	48.3	4.74	0.71
MEDIAN	20.4	11.3	0.22	0.06

APPENDIX C

Figures 3.1 Through 3.3

Figure 3.1 Chloride Concentrations Measured in EDCC Tributary During 1995-1997.

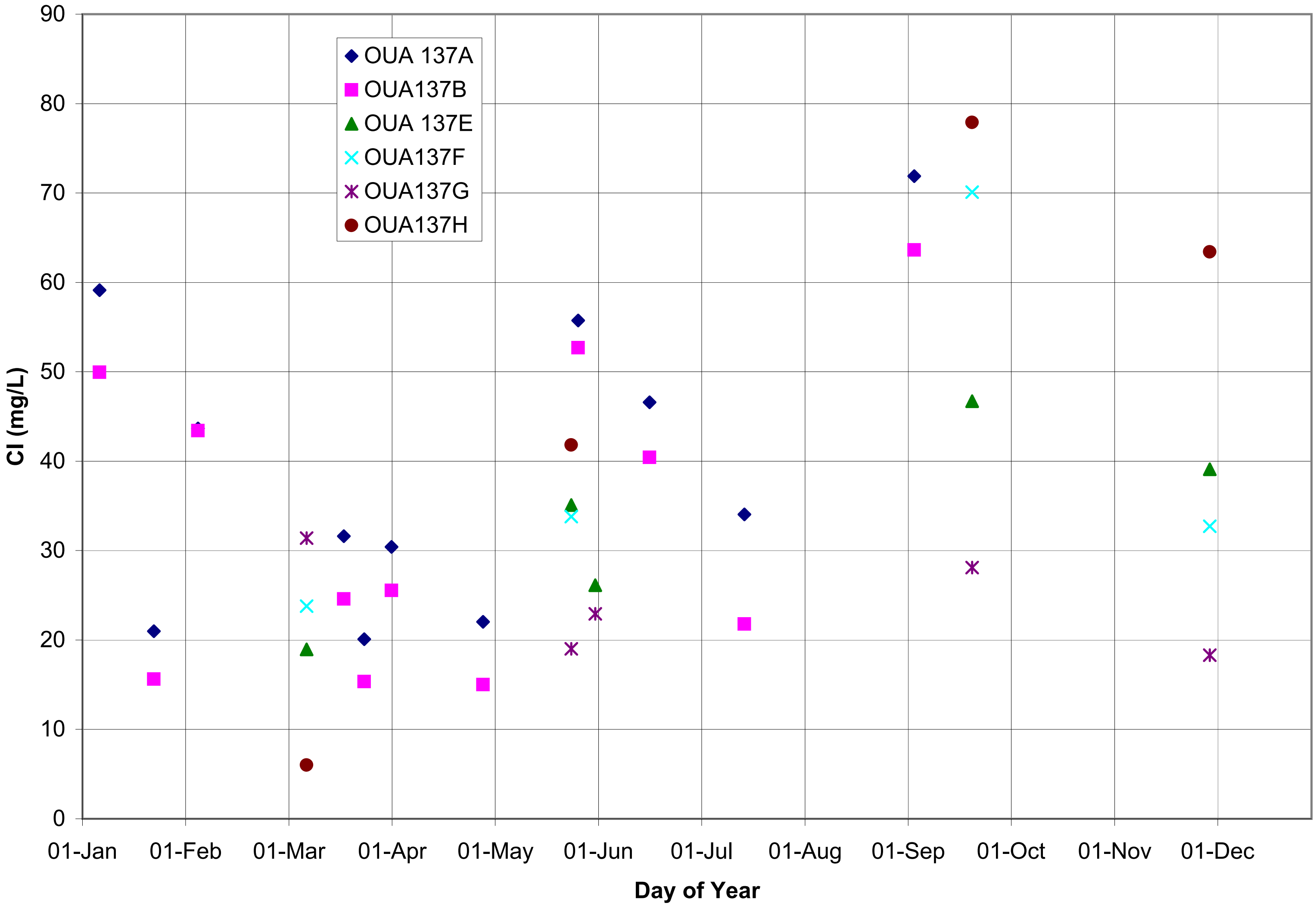


Figure 3.2 Sulfate Concentrations Measured in EDCC Tributary During 1995-1997.

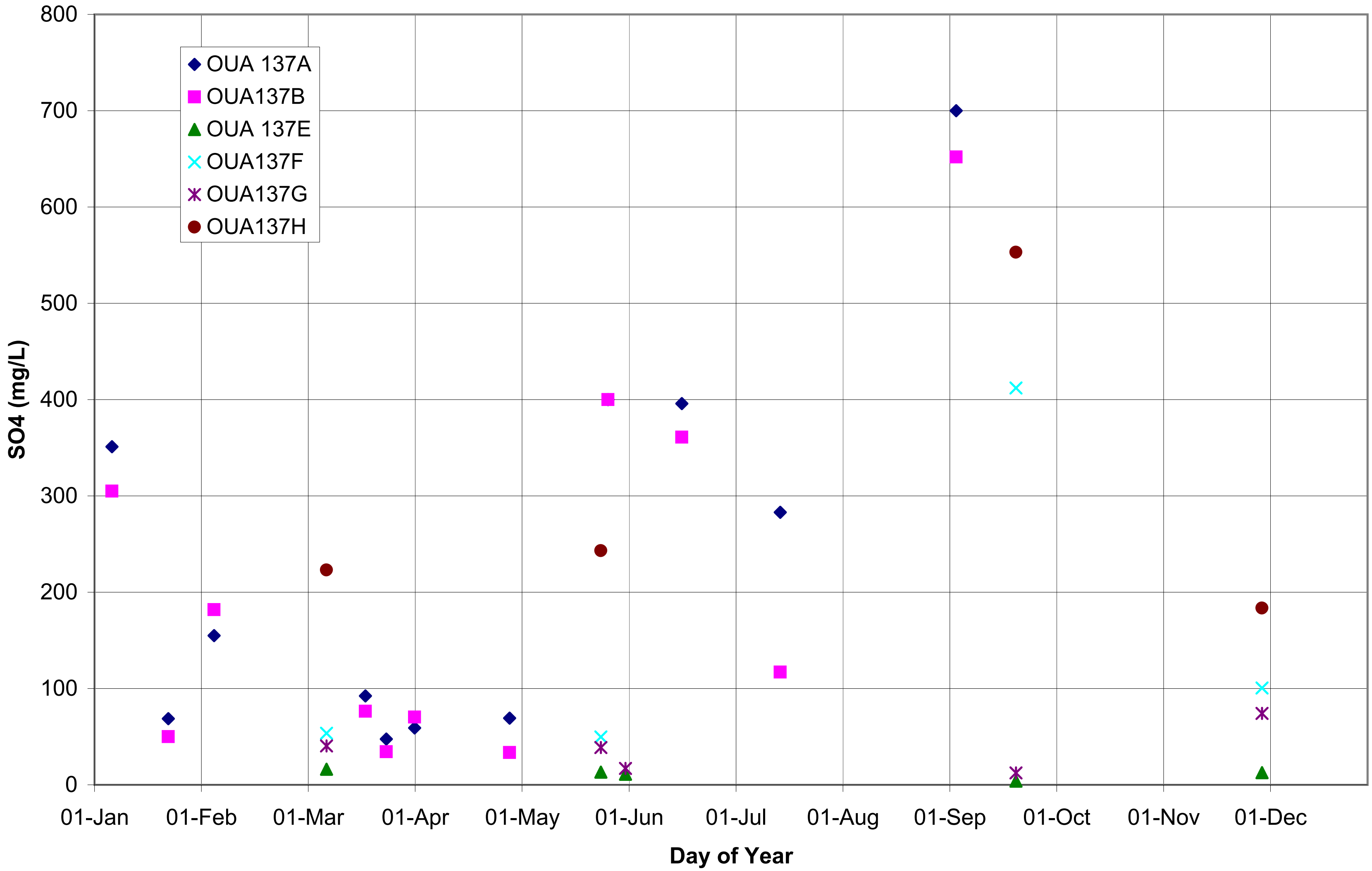
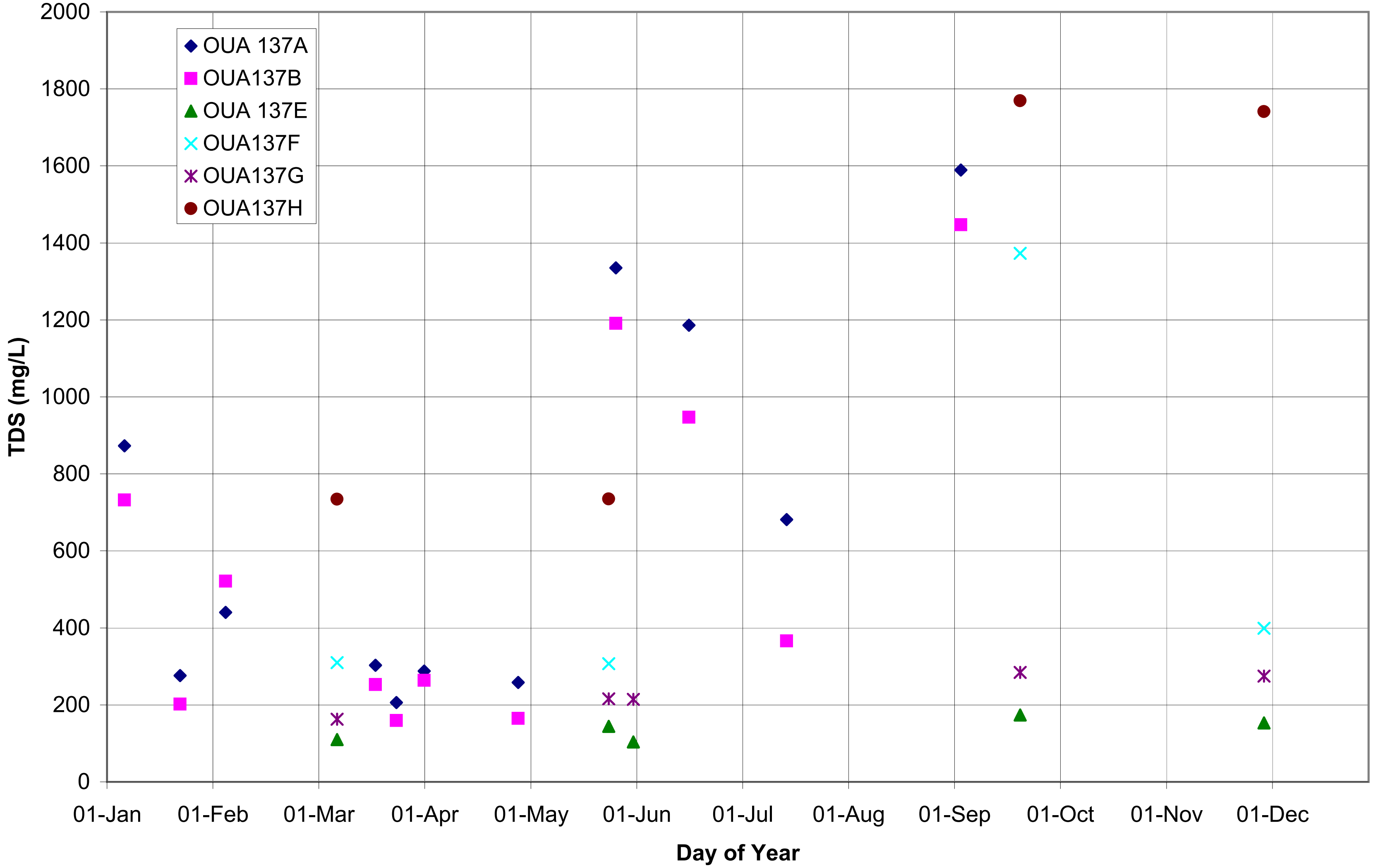


Figure 3.3 TDS Concentrations Measured in EDCC Tributary During 1995-1997.



APPENDIX D

Dissolved Mineral TMDL Calculations for ELCC Tributary

TABLE D.1. TOTAL **CURRENT** LOADS OF DISSOLVED MINERALS FOR ELCC TRIBUTARY

Measured concentrations at Station OUA137B:
(near mouth of ELCC Tributary, but upstream of City of Norphlet STP loading)

	Chlorides (mg/L)	Sulfates (mg/L)	TDS (mg/L)
1/24/95	15.6	50.0	202
3/21/95	24.6	76.4	253
4/4/95	25.5	70.4	264
9/5/95	63.6	652	1447
1/8/96	49.9	305	732
2/6/96	43.4	182	521
3/26/96	15.3	34.4	159
4/30/96	15.0	33.4	165
5/28/96	52.7	400	1191
6/18/96	40.4	361	947
7/16/96	21.8	117	366
6/3/97	27.9	50.8	229
Averages:	33.0	194.4	540

Calculation of flow and loads at mouth of ELCC Tributary:

Avg annual runoff for USGS gage on Smackover Creek =	15.0	in/yr
Total drainage area for ELCC Tributary at mouth =	22.54	mi2

Average annual streamflow for ELCC Tributary at mouth =	16.10	MGD

(Flow = Runoff, in/yr * Drainage area, mi2 * conversions)

Average annual loads for ELCC Tributary w/o City of Norphlet STP loads:

(Load = Flow, MGD * Conc, mg/L * 8.34)	Chlorides =	4431	lbs/day	(using OUA137B concs)
	Sulfates =	26103	lbs/day	(using OUA137B concs)
	TDS =	72508	lbs/day	(using OUA137B concs)

Flow and concentrations for City of Norphlet STP:

Design flow =	0.18	MGD	(from PCS)
Typical chlorides concentration =	70	mg/L	(from literature)
Typical sulfates concentration =	45	mg/L	(from literature)
Typical TDS concentration =	500	mg/L	(from literature)

Average annual loads for City of Norphlet STP:

Chlorides =	105	lbs/day
Sulfates =	68	lbs/day
TDS =	751	lbs/day

Average annual current loads for ELCC Tributary at mouth:

Chlorides =	4536	lbs/day
Sulfates =	26171	lbs/day
TDS =	73259	lbs/day

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

TABLE D.2. TOTAL **ALLOWABLE** LOADS (TMDLs) OF DISSOLVED MINERALS FOR ELCC TRIBUTARY

Maximum naturally occurring levels:	Chlorides =	14	mg/L	(Reg 2, page 5-11)
	Sulfates =	31	mg/L	(Reg 2, page 5-11)
	TDS =	123	mg/L	(Reg 2, page 5-11)

For chlorides and sulfates, standards are 1/3 increase or 15 mg/L increase, whichever is less, over maximum naturally occurring levels. For TDS, standard is maximum naturally occurring level plus sum of increases in chlorides and sulfates (over maximum naturally occurring levels). (Reg 2, Section 2.511)

Water quality standards:	Chlorides =	19	mg/L
	Sulfates =	41	mg/L
	TDS =	138	mg/L

Average annual streamflow for ELCC Tributary at mouth = 16.10 MGD (from Table D.1)

Average annual allowable loads (TMDLs) for ELCC Tributary at mouth:

(Load = Flow, MGD * Conc, mg/L * 8.34)	Chlorides =	2551	lbs/day	Note: Values in shaded
	Sulfates =	5505	lbs/day	cells used in Table 4.1
	TDS =	18530	lbs/day	

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

TABLE D.3. DISSOLVED MINERAL LOADS FOR SOURCES **NOT TARGETED** FOR REDUCTION

The following TMDL components are calculated here:

- LA for background sources
- WLA for Wildwood Trailer Park
- WLA for City of Norphlet

Concentrations for background sources (based on reference stream data):

Chlorides =	5	mg/L	(from CPP)
Sulfates =	13	mg/L	(from CPP)
TDS =	67	mg/L	(from CPP)

Average annual flow for ELCC Tributary at mouth = 16.10 MGD (from Table D.1)

Average annual loads for background sources:

Chlorides =	671	lbs/day	Note: Values in shaded cells used in Table 4.1
Sulfates =	1746	lbs/day	
TDS =	8996	lbs/day	

Typical concentrations for Wildwood Trailer Park and City of Norphlet:

Chlorides =	70	mg/L	(from literature)
Sulfates =	45	mg/L	(from literature)
TDS =	500	mg/L	(from literature)

Design flows for Wildwood Trailer Park and City of Norphlet:

Wildwood Trailer Park =	0.031	MGD	(from PCS)
City of Norphlet =	0.18	MGD	(from PCS)

Average annual loads for Wildwood Trailer Park:
(Load = Flow, MGD * Conc, mg/L * 8.34)

Chlorides =	18	lbs/day
Sulfates =	12	lbs/day
TDS =	129	lbs/day

Note: Values in shaded cells used in Table 4.1

Average annual loads for City of Norphlet:

Chlorides =	105	lbs/day
Sulfates =	68	lbs/day
TDS =	751	lbs/day

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

TABLE D.4. DISSOLVED MINERAL LOADS FOR SOURCES **TARGETED** FOR REDUCTION

The following TMDL components are calculated here:

- WLA for ELCC non-stormwater outfalls
- LA for ELCC stormwater outfalls
- LA for man-induced nonpoint sources
- Margin of safety

	Chlorides (lbs/day)	Sulfates (lbs/day)	TDS (lbs/day)	
Total CURRENT load for 3 targeted sources combined :				
Total current load for ELCC Tributary at mouth	4536	26171	73259	(from Table D.1)
minus background load	-671	-1746	-8996	(from Table D.3)
minus City of Norphlet WLA	-105	-68	-751	(from Table D.3)
minus Wildwood Trailer Park WLA	-18	-12	-129	(from Table D.3)
equals total current load for 3 targeted sources:	3742	24345	63383	
Total ALLOWABLE load for 3 targeted sources combined :				
TMDL for ELCC Tributary at mouth	2551	5505	18530	(from Table D.2)
minus background load	-671	-1746	-8996	(from Table D.3)
minus City of Norphlet WLA	-105	-68	-751	(from Table D.3)
minus Wildwood Trailer Park WLA	-18	-12	-129	(from Table D.3)
Totals:	1757	3679	8654	
times 90% (to incorporate margin of safety)	x 90%	x 90%	x 90%	
equals total allowable load for 3 targeted sources:	1581	3311	7789	
Margin of safety (MOS):				
Totals from above (before multiplying by 90%)	1757	3679	8654	
times 10%	x 10%	x 10%	x 10%	
equals margin of safety	176	368	865	Note: Values in shaded cells used in Table 4.1
Uniform percent reduction for 3 targeted sources:				
(current load - allowable load) / current load =	57.7%	86.4%	87.7%	

Now, take the total allowable load for 3 components combined and divide it up proportional to the current loads for each of the 3 components:

	Chlorides (lbs/day)	Sulfates (lbs/day)	TDS (lbs/day)	
Current loads for each of these 3 components:				
ELCC non-stormwater outfalls	628	3698	10890	(from Table D.5)
ELCC stormwater outfalls	173	243	5169	(from Table D.6)
Man-induced nonpoint sources	2941	20404	47324	(from Table D.7)
Percentage of combined load for each of 3 components:				
ELCC non-stormwater outfalls	16.8%	15.2%	17.2%	
ELCC stormwater outfalls	4.6%	1.0%	8.2%	
Man-induced nonpoint sources	78.6%	83.8%	74.7%	
Totals:	100.0%	100.0%	100.0%	
ALLOWABLE loads for 3 targeted sources:				
ELCC non-stormwater outfalls	265	503	1338	Note: Values in shaded cells used in Table 4.1
ELCC stormwater outfalls	73	33	635	
Man-induced nonpoint sources	1243	2775	5816	
Totals:	1581	3311	7789	

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

TABLE D.5. CURRENT LOADS OF DISSOLVED MINERALS FOR ELCC NON-STORMWATER OUTFALLS

		chlorides (mg/L)		sulfates (mg/L)		TDS (mg/L)	
		001	003	001	003	001	003
DMRs	9/30/99			188			
	11/30/99			485			
	1/31/00			467			
	2/29/00			398			
	4/30/00			246			
	5/31/00			184			
	6/30/00			252			
	7/31/00			219			
	9/30/00			257			
	10/31/00			259			
	11/30/00			243			
	12/31/00			191			
	1/31/01			142			
	2/28/01			121			
	3/31/01			75			
	4/30/01			117			
	6/30/01			154			
	9/30/01			299			
FTN	2/27-28/90			150			
	3/26-27/90	26	11	190	44	500	220
	9/19/90	68	35	420	29	990	300
	4/10-11/91	33	16	190	50	650	460
	4/10-11/91**	35	7	255	50	669	423

**analyzed by ELCC

Average concs (mg/L) =	40.5	17.3	239.2	43.3	702	351
Design flows (MGD) =	1.85	0.02	1.85	0.02	1.85	0.02
Loads (lbs/day) =	625	3	3691	7	10831	59
Loads (lbs/day) for both outfalls combined = (used in Table D.4)	628		3698		10890	

Note: Load, lbs/day = Flow, MGD * Conc, mg/L * 8.34

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

TABLE D.6. CURRENT LOADS OF DISSOLVED MINERALS FOR ELCC STORMWATER OUTFALLS

		chlorides (mg/L)					sulfates (mg/L)						TDS (mg/L)				
		002	004	005	006	007	002	004	005	006		007	002	004	005	006	007
DMRs	8/2/93			7.3	31.0	30.0			124.0	42.5	42.5	78.0					
	6/6/94			40.0	35.7	31.6			51.0	< 1.0	0.5	49.0					
	6/16/96			25.0	27.0	4.0			149.0	50.0	50.0	129.0					
	6/26/97			24.5	20.0	27.0			54.0	111.0	111.0	12.0					
	5/26/98			24.7	18.4	9.7											
	6/21/00			1.4	10.8	20.1			10.8	5.3	5.3	99.5					
	6/5/01			25.1	6.3	46.7			2.5	47.2	47.2	534.0					
FTN	2/27-28/90							30.0									
	3/26-27/90		16					70.0						1500			
	9/19/90		790					4.0						1700			
	4/10-11/91		140					360.0						2300			
	4/10-11/91**		161					18.0						2013			

**analyzed by ELCC

Average conc. (mg/L)
for each parameter = 62.9 (chlorides), 88.3 (sulfates), 1878 (TDS)

Size of manufacturing area at ELCC facility = 300 acres (from FTN 1991)

Avg annual runoff for USGS gage on Smackover Creek = 15.0 in/yr (from Table D.1)

Avg annual flow from manufacturing area at ELCC = 0.33 MGD (drainage area * runoff * conversions)

Avg ann'l loads for ELCC stormwater outfalls: Chlorides = 173 lbs/day
(used in Table D.4) Sulfates = 243 lbs/day
TDS = 5169 lbs/day

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

TABLE D.7. CURRENT MAN-INDUCED NPS WATERSHED LOADS FOR ELCC TRIBUTARY

	Chlorides (lbs/day)	Sulfates (lbs/day)	TDS (lbs/day)	
Total current load for 3 targeted sources	3742	24345	63383	(from Table D.4)
minus ELCC non-stormwater current load	-628	-3698	-10890	(from Table D.5)
minus ELCC stormwater current load	-173	-243	-5169	(from Table D.6)
equals current man-induced NPS load (used in Table D.4)	2941	20404	47324	

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_MINERALS.XLS

APPENDIX E

Documentation of QUAL2E Model for ELCC Tributary

APPENDIX E
IS AVAILABLE FROM EPA
UPON REQUEST

APPENDIX F

Ammonia TMDL Calculations for ELCC Tributary

TABLE F.1. AMMONIA TOXICITY CALCULATIONS FOR EDCC TRIBUTARY

Equations are from 1999 Update of Ambient Water Quality Criteria for Ammonia (EPA-822-R-99-014, Dec. 1999).

Use chronic criterion when fish early life stages are present (as mentioned on page 88, this is the same as CCC for early life stages absent when temp > 15°C)

CCC, in mg N/L = $[0.0577/(1+10^{7.688\text{-pH}}) + 2.487/(1+10^{\text{pH-}7.688})] * \text{MIN}\ [2.85, 1.45*10^{0.028*(25\text{-}T)}]$

Note: CCC is the Chronic Criterion Concentration

pH values used in these calculations are average values for Station OUA137A (see data below). Temperature values used in these calculations are based on ADEQ Reg 2 (water quality standards).

Season	Average pH (su)	Temperature (°C)	Calculated CCC (mg N/L)
Summer	6.58	30.0	2.43
Winter	6.40	22.0	4.17

pH values for Station OUA137A (downstream of EDCC outfalls):

Summer (May - Oct):

Date	Value
9/5/95	6.60
5/28/96	6.42
6/18/96	6.83
7/16/96	6.08
6/3/97	6.99
Average:	6.58

Winter (Nov - Apr):

Date	Value
1/24/95	6.62
3/21/95	6.82
4/4/95	6.75
1/8/96	6.15
2/6/96	6.67
3/26/96	5.88
4/30/96	5.91
Average:	6.40

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_AMMONIA.XLS

TABLE F.2. AMMONIA MASS BALANCE CALCULATIONS FOR ELCC TRIBUTARY

Note: Shaded cells are used in Table 4.2

	City of Norphlet	Wildwood Trailer Park	ELCC Outfalls 001 & 003	Data Source / Comments
Summer:				
Upstream flow (Qu, MGD)	0	0	0	from 1991 FTN report
Upstream conc. (Cu, mg/L)	0.32	0.32	0.32	avg for OUA137E (from Table F.3)
Upstream load (Lu, lbs/day)	0	0	0	Lu = Qu * Cu * 8.34
Effluent flow (Qe, MGD)	0.18	0.031	1.87	Norphlet and Wildwood flows from PCS ELCC flows from mass and conc. limits
Downstream flow (Qd, cfs)	0.18	0.031	1.87	Qd = Qu + Qe
Downstream conc. (Cd, mg/L)	2.43	2.43	2.43	maximum allowable (from Table F.1)
Downstream load (Ld, lbs/day)	3.65	0.63	37.9	Ld = Qd * Cd * 8.34
Allow. effluent load (Le, lbs/day)	3.65	0.63	37.9	Le = Ld – Lu
Allow. effluent conc. (Ce, mg/L)	2.43	2.44	2.43	Ce = Le / Qe / 8.34
Current effl. conc. (Ce1, mg/L)	0.53	0.08	103.6	medians of DMR data (from Table F.4)
Percent reduction req'd (PR)	none	none	97.7%	PR = (Ce1 - Ce) / Ce1
Winter:				
Upstream flow (Qu, MGD)	0.646	0.646	0.646	from 1991 FTN report
Upstream conc. (Cu, mg/L)	0.32	0.32	0.32	avg for OUA137E (from Table F.3)
Upstream load (Lu, lbs/day)	1.72	1.72	1.72	Lu = Qu * Cu * 8.34
Effluent flow (Qe, MGD)	0.18	0.031	1.87	Norphlet and Wildwood flows from PCS ELCC flows from mass and conc. limits
Downstream flow (Qd, cfs)	0.826	0.677	2.516	Qd = Qu + Qe
Downstream conc. (Cd, mg/L)	4.17	4.17	4.17	maximum allowable (from Table F.1)
Downstream load (Ld, lbs/day)	28.73	23.54	87.5	Ld = Qd * Cd * 8.34
Effluent load (Le, lbs/day)	27.01	21.82	85.78	Le = Ld – Lu
Allow. effluent conc. (Ce, mg/L)	17.99	84.4	5.5	Ce = Le / Qe / 8.34
Current effl. conc. (Ce1, mg/L)	0.53	0.08	103.6	medians of DMR data (from Table F.4)
Percent reduction req'd (PR)	none	none	94.7%	PR = (Ce1 - Ce) / Ce1

Total upstream loads for all 3 sources:	Summer =	0	lbs/day
	Winter =	5.16	lbs/day

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_AMMONIA.XLS

TABLE F.3 UPSTREAM AMMONIA CONCENTRATIONS FOR ELCC TRIBUTARY

Measured ammonia data for Station OUA137E (upstream of ELCC outfalls):

Date	Value
3/10/97	0.30
5/27/97	0.40
6/3/97	0.20
9/22/97	0.25
12/1/97	0.43
Average:	0.32

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_AMMONIA.XLS

TABLE F.4. CURRENT EFFLUENT CONCENTRATIONS OF AMMONIA (based on available DMRs)

	ELCC Outfall 001 (mg/L)
Sep-99	57.4
Nov-99	63.1
Jan-00	103
Feb-00	118.6
Apr-00	106.4
May-00	70.3
Jun-00	90.1
Jul-00	86.9
Sep-00	57.9
Oct-00	88
Nov-00	99
Dec-00	201
Jan-01	280
Feb-01	246
Mar-01	125
Apr-01	149
Jun-01	118
Sep-01	123
Median:	104.7

	ELCC Outfall 003 (mg/L)
Oct-99	1.37
Jan-00	0.5
Apr-00	1.6
Jul-00	2.0
Oct-00	0.5
Jan-01	1.11
Apr-01	< 0.5
Jul-01	< 0.5
Oct-01	< 0.5
Median:	0.50

Note: Non-detect values were set to half of the detection limit for averaging.

	City of Norphlet (mg/L)
Sep-99	1.27
Oct-99	0.65
Nov-99	0.04
Dec-99	0.10
Feb-00	0.01
Mar-00	17.90
May-00	15.18
Jun-00	2.38
Oct-00	0.40
May-01	0.40
Jun-01	6.20
Jul-01	0.19
Median:	0.53

	Wildwood Trailer Park (mg/L)
Oct-99	0.01
Jan-00	0.01
Apr-00	0.14
Jul-00	0.02
Oct-00	0.02
Jan-01	2.62
Apr-01	3.09
Jul-01	0.25
Median:	0.08

Design flow for Outfall 001 = 1.85 MGD
Design flow for Outfall 003 = 0.02 MGD

Flow-weighted median conc. for ELCC outfalls = 103.6 mg/L

FILE: R:\PROJECTS\2110-550\TMDL_ELCC_AMMONIA.XLS

APPENDIX G

Responses to Comments

COMMENTS AND RESPONSES
TMDLs FOR CHLORIDE, SULFATE, TDS, AND AMMONIA
IN THE ELCC TRIBUTARY, ARKANSAS
December 16, 2002

EPA appreciates all comments concerning these TMDLs. Comments that were received are shown below with EPA responses or notes inserted in a different font.

COMMENTS FROM GBMc ASSOCIATES ON BEHALF OF EL DORADO CHEMICAL COMPANY:

We have reviewed the referenced TMDLs and the related documentation for the referenced parameters in relation to the ELCC Tributary (the waterbody). On behalf of El Dorado Chemical Company (EDCC) we offer the following comments organized by subject areas:

Additional Biological Data

The TMDL study did not utilize additional biological data transmitted to the Arkansas Department of Environmental Quality (ADEQ) in September 2001. This data provided the results of a screening level bioassessment of the waterbody at the same location used in the TMDL investigation performed by ADEQ and published in April 1998.

This bioassessment documented that the fish community of the unnamed tributary was characteristic of a small stream in the Gulf Coastal Ecoregion. The fish community assemblage included 3 key species and 4 indicator species as described in the WQS. Those species were collected in multiple size classes indicating that reproduction and recruitment were supported within that reach of the waterbody. Please find attached a copy of the 2001 transmittal to the ADEQ. Based upon those findings, we request that the TMDLs be revised to include an assessment of the need for the continued listing of the waterbody on the 303(d) list and an explanation why this information was not utilized in the preparation of the TMDL.

Response: EPA appreciates the identification of additional data for this watershed and has revised Section 2.7 of the report (Previous Studies) to acknowledge these data. However, these biological data do not directly affect the dissolved minerals TMDLs because the TMDLs were developed based on existing numeric water quality standards. The stream was included on the 303(d) list for not meeting these standards; therefore, it was required that the dissolved minerals TMDLs be developed using these numeric standards as the endpoints.

Historical Studies

The TMDL study did not utilize the findings of the 1991 FTN surface water quality study which concluded that water quality standard amendments related to dissolved minerals (chloride, sulfate and TDS) were appropriate and should be initiated. That study concluded that dissolved minerals were not precluding attainable uses (including the fisheries use) and that increases in the protective criteria for dissolved minerals were appropriate along with removal of the designated domestic water supply use. We are unaware of any data that contradicts the 1991 FTN report regarding dissolved minerals and the more recent biological assessment as discussed above further documents that the designated Gulf Coastal fishery use is present in the waterbody.

The 1991 FTN report (developed by the same consulting firm who performed these TMDLs for USEPA) should be considered in the finalization of the dissolved minerals TMDLs. Based on that documentation and the more recent biological assessment, we request that the TMDL: be revised to: 1) eliminate the allocation of dissolved minerals, 2) recommend that the water quality criteria for dissolved minerals be amended to reflect current conditions and, 3) recommend that the designated, but not existing, domestic water supply use be removed from the waterbody. The last two recommendations parallel the conclusions of the FTN 1991 report. The TMDL report reflects that the application to amend the water quality criteria recommended in the FTN 1991 report was denied, which is incorrect. The application was withdrawn, due to objections, which were based on the existence of ammonia toxicity. Through the implementation of this TMDL, and NPDES permitting activities of ADEQ, that ammonia toxicity will be eliminated, which will remove the only barrier to approval of the dissolved mineral criteria change, and removal of the water supply use.

Response: The comment is correct that the 1991 FTN report recommended removal of the domestic water supply use and changes to the dissolved minerals standards for this stream. Section 2.4 of this report has been revised to mention these recommended changes and Section 3.2 has been revised to indicate that the application was withdrawn rather than denied. However, neither removal of the domestic water supply use nor changes to the dissolved minerals standards has been implemented to date. Both Section 303(d)(1)(C) of the Clean Water Act and 40 CFR 130.7(c)(1) require that TMDLs be based on applicable (i.e., existing) standards. The purpose of TMDLs is to determine allowable loadings based on existing standards, not to make recommendations for changing the standards. If the dissolved minerals standards for this stream are changed in the future, the TMDLs can be revised at that time to reflect the change.

Ambient Water Quality Data Limitations

The ambient water quality data for the waterbody used in the preparation of the TMDLs has significant deficiencies. As is seen upon review, the data was collected between 1991 to 1997. None of the data is more current than December 1997. Data that old is not traditionally used to assess current conditions.

Response: The allowable loadings of dissolved minerals for this stream were calculated based on water quality standards, not ambient water quality data. The ambient data were used to characterize current conditions and estimate percent reductions needed to meet standards. These ambient data were the best and most current data that were available and they are considered to be acceptable for this purpose. Also, no evidence was presented in these comments that indicates any changes in dissolved mineral concentrations in the stream since 1997.

In addition, although the dissolved minerals TMDLs are based upon the maintenance of water quality criteria under average flow conditions, there is no information to correlate the ambient monitoring data for the ELCC Tributary with flow. Based on the data presented, it appears that no storm event sampling was utilized in the study nor was the sampling data correlated with the intermittent discharges from EDCC. It should be noted that EDCC's Outfall 001 does not have a constant discharge and often is shut off for months during the summer. EDCC's other outfalls of concern are storm water discharges in response to rain events at which time elevated stream flows occur. These characteristics are not considered in the TMDL report.

The TMDL study does not appropriately document ambient waterbody conditions as needed to correctly assess point source and nonpoint source loadings. This is due to the age of the data and because the data was not collected under a long-term sampling program designed specifically to characterize the variable water quality resulting from the intermittent nature of the flow regime of the waterbody and the discharges from EDCC. We recommend that no TMDL be finalized until such time as appropriate ambient monitoring (including flow measurements) is conducted.

Response: As discussed in Section 4.1.1 of the report, the determination of critical conditions was based on analysis of available data, which did not include continuous stream flow data or daily effluent flow data. The analysis of available data also considered the impact of nonpoint sources as well as point sources. Collecting additional data and performing additional analyses of water quality variability was not considered necessary for developing these TMDLs. If additional field data are collected in the future that warrant a change in the TMDLs, then the TMDLs can be revised accordingly at that time.

Ammonia TMDL Determination

The recommended TMDL for ammonia is predicated on the maintenance of the USEPA's criteria for ammonia toxicity. There are a number of limitations to this approach centering on the applicability of those criteria as a water quality standard in Arkansas and the designated fishery use for the waterbody at the location of the discharges from EDCC. The following sections discuss these issues.

At this time, the Arkansas Department of Environmental Quality (ADEQ) has not adopted the USEPA's criteria for ammonia toxicity as a water quality standard in the State of Arkansas. The potential adoption of those criteria as a water quality standard is one of the issues of discussion for the water quality standards workgroup meetings currently being conducted by the ADEQ. An essential part of the adoption of the ammonia toxicity criteria as a water quality standard will be the implementation process. This implementation process will be used to determine if instream exceedences of the ammonia toxicity standard, if adopted, exist under the appropriate critical flow. The use of the USEPA's recommended ammonia toxicity criteria as the basis for a TMDL is premature and in fact represents the adoption of the criteria in the State of Arkansas without the benefit of rulemaking. This is a violation of due process which has the potential to result in extremely stringent effluent discharge limitations for ammonia as the TMDL (as stated in Section 5.0) calls for implementation through NPDES permit limitations.

Response: Development of a TMDL based on an EPA criterion does not constitute adoption of that criterion as a state water quality standard (WQS), nor does it constitute development of a federal WQS to supercede a state WQS. Therefore, use of an EPA criterion in a TMDL is not a violation of rulemaking or due process. In this TMDL, EPA ammonia criteria were used as numeric endpoints to address Arkansas's narrative WQS that does not allow discharges to cause toxicity (Section 2.409 of Regulation No. 2). Ammonia was identified as the primary toxic compound for this stream (see top of page 3-2 of this report, which refers to conclusions on page 33 of ADEQ 1998 report). Because TMDLs are quantitative in nature as established by federal law, a quantitative measure (i.e., a numeric target) must be selected to establish the relationship between the narrative standard and the impact on water quality. If a state does not have a strategy for implementing a narrative standard and does not complete its TMDL responsibilities, then EPA has the responsibility to develop the TMDL establishing necessary numeric target values. These numeric targets may be used to set NPDES permit effluent limits, set goals for nonpoint source BMPs, and track TMDL effectiveness, but they are not WQS and do not have the same applicability as WQS. These target values may be modified or adjusted as additional data or information warrants, without the need to go through the formal process for setting WQS.

The second issue of importance is that the TMDL develops year round ammonia loadings for Outfall 001 based on an erroneous regulatory interpretation of Regulation No. 2, the State of Arkansas Water Quality Standards (WQS) that a perennial fishery exists at the Outfall 001 discharge location to the waterbody. The TMDLs determination is wrong because the watershed of the unnamed tributary into which EDCC's Outfall 001 discharges is less than 10 square miles and the outfall averages less than 1 cfs in volume on an annual basis. While Outfall 001 does occasionally have discharge volumes of greater than 1 cfs, it does not discharge on a constant basis. During the period of time from January 2000 through May 2002, on a daily basis, there was no discharge from Outfall 001 approximately 59% of the time and the average discharge (factoring in the days of no discharge) was 0.621 cfs. This is clearly less than the 1 cfs value defined in the WQS as needed to qualify the tributary for a perennial fishery use. Consequently the TMDL is incorrect in that it sets non-seasonal period loadings for ammonia based on the erroneous WQS interpretation concerning the maintenance of a perennial fishery use in the unnamed tributary into which Outfall 001 discharges.

Since the waterbody at the outfall 001 discharge location is designated as a seasonal fishery, the TMDL could only be used as the basis for ammonia loadings during the timeframe when the seasonal fishery use is present as defined by the WQS.

For these reasons, we recommend that the ammonia TMDL for the waterbody be deferred until such time as the ADEQ completes its WQS rulemaking for ammonia and then determines the appropriate implementation process regarding point source discharges.

Response: The ELCC Tributary is considered by ADEQ to have a perennial fishery, which has been previously stated in both the FTN 1991 report (page 3-31) and in the ADEQ 1998 report (top of page 2). Section 2.4 of this report has been revised to document this issue. ADEQ’s standard procedure is to use the design flow of a discharge when determining whether or not there is a seasonal or perennial fishery downstream of the discharge. ADEQ consistently uses this procedure for both continuous and intermittent discharges. The design flow of Outfall 001 is 1.85 MGD, or 2.86 cfs.

Dissolved Minerals

Similar to the fishery use designation issue discussed above, the TMDL allocations as developed for dissolved mineral (chloride, sulfate and TDS) are based on erroneous regulatory interpretations of the WQS. This misinterpretation is based on the definition of critical flow as contained in Section 2.106 of the WQS. This section reads as follows:

> "Critical flows: The flow volume used as background dilution flows in calculating concentrations of pollutants from permitted discharges. These flows may be adjusted for mixing zones. The following critical flows are applicable:
>
> For a seasonal fishery – 1 cfs minus the design flow of any point source discharge (may not be less than zero).
>
> For human health criteria – harmonic mean flow or long term average flow.
>
> For minerals criteria – harmonic mean flow or 4 cfs, except in those waters listed in Section 2.510. Those waters in Section 2.510 which are noted with an asterisk will have a critical flow of 4 cfs. (Also see minerals implementation procedure in CPP).
>
> For all others – the critical flow will be Q7 – 10."

As is evident by this definition, under the WQS critical flows are specifically applicable to permitted discharges and nonpoint sources are not mentioned. Under this regulatory framework, the allocation of dissolved minerals loadings from permitted discharges are primary to those for nonpoint sources.

In this context, the TMDLs for dissolved minerals should be amended to allocate dissolved minerals loadings at the appropriate critical flows to the permitted point source discharges pursuant to the definition of the WQS. The TMDLs' current allocation processes, which treat unpermitted nonpoint sources as equal to permitted discharges at the critical flow, are not supported by the WQS. Through its inclusion of nonpoint sources as being equal to permitted discharges, the TMDL constitutes a revision to the critical flow definition of the WQS without the benefit of rulemaking and due process.

Response: Based on Regulation No. 2 and the Continuing Planning Process (CPP) for Arkansas, the background flow of 4 cfs is intended for establishing permit limits for point source discharges only when insufficient data are available to determine the harmonic mean flow upstream of the discharge. According to page D-18 of the CPP, the value of 4 cfs was based on median flows for streams with drainage areas of about 10 mi^2. If a harmonic mean flow was actually developed for the area upstream of the ELCC outfalls, it would probably be much smaller than 4 cfs because that drainage area is much smaller than 10 mi^2.

However, the focus of these TMDLs was the entire length of the ELCC Tributary (Reach 08040201-606), not just the portion of the stream immediately downstream of the ELCC outfalls. For the entire stream, critical conditions should be based on harmonic mean flows (although annual average flows were used due to a lack of continuous flow data). Therefore, the allowable loadings from all sources were calculated so that the dissolved minerals standards would be maintained all along the stream under annual average flow conditions. In order for the standards to be maintained in all portions of the stream under annual average flow conditions, the allowable point source loadings had to be computed for annual average flow conditions. This was considered to be consistent with the following requirement near the end of Section 2.511 of Regulation No. 2 concerning discharges of dissolved minerals: "In no case shall discharges cause ... concentrations to exceed the applicable limits in the streams to which they are tributary...." In other words, the point source discharges must not cause an exceedence of the dissolved minerals standards in any part of the ELCC Tributary.

Conclusion

The TMDLs as developed have significant limitations. These include the interpretation of the WQS, the use of outdated ambient water quality data, the lack of utilization of all available information and the use of USEPA's recommended water quality criteria for ammonia which have not been adopted as a water quality standard in Arkansas. For these reasons we request that the TMDLs be revised to address these concerns.

Response: See responses to specific comments above.